

**Application for a Locally Adopted Energy Standards
by the City of Santa Rosa In Accordance With
Section 10-106 of the California Code of Regulations,
Title 24, Part 1**

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1.0 Executive Summary

The City of Santa Rosa has researched and reviewed the feasibility and cost-effectiveness of building permit applicants exceeding the performance requirements of the 2005 Building Energy Efficiency Standards. Having developed final language for the Santa Rosa Energy Efficiency Ordinance (see Section 5), and having the Ordinance approved by the Santa Rosa City Council on December 18, 2007, the City would like to implement the Ordinance at the earliest convenient date following approval by the California Energy Commission.

Per the criteria stated in the California Code of Regulations, Title 24, Part 1, Section 10-106, Locally Adopted Energy Standards: These local standards will require buildings to be designed to consume no more energy than permitted by Title 24, Part 6. This application to the California Energy Commission.

The City of Santa Rosa has retained Gabel Associates, LLC to assist the City in this application to the Commission. As stated in the Ordinance application, the proposed local energy efficiency standards and implementation have been designed with several key criteria in mind. These include:

- Consistency with the structure, format and calculation methods of the 2005 Title 24 Building Energy Efficiency Standards;
- Simplicity and clarity for building department enforcement for energy plan review and field inspection;
- Meeting the local energy compliance requirements as defined by the Ordinance which exceed the 2005 Title 24 standards; and,
- The provision of flexibility for building permit applicants in meeting the Ordinance by the performance approach using building and appliance energy conservation measures.

The proposed Ordinance shall take effect only after the Commission has reviewed and formally approved the proposed local energy standards as meeting all requirements of Section 10-106, and the Ordinance has been filed with the Building Standards Commission.

Statement per Section 10-106(b)3. The proposed Ordinance requires that all buildings are designed to consume no more TDV energy than permitted by Title 24, Part 6. The main features of the proposed ordinance are that:

- (a) New single family homes and new multi-family low-rise residential buildings consume at least 15% less TDV energy than the energy use permitted by the 2005 standards; and,
- (b) New high-rise residential buildings (i.e., four story or higher residential apartments) consume at least 15% less TDV energy than the energy use permitted by the 2005 standards;

With respect to any technical questions concerning the development, methodology, descriptions or implementation outlined in this application, please contact Michael Gabel at Gabel Associates, LLC.

2.0 Impacts of the New Ordinance

2.1 Single Family Homes

The following methodology and assumptions are used in evaluating the impact of the Ordinance on single family homes.

Home Designs. Four recent actual home designs (1418 SF, 1775 SF, 2682 SF and 3024 SF) submitted to a local building department have been modeled in an effort to determine the cost-effectiveness of the proposed City of Santa Rosa Energy Ordinance. An additional design, 950 SF, was created to model very small homes with a high percentage of glass. Each design, as summarized below, just meets the 2005 Building Energy Efficiency Standards. Other energy designs were developed to just meet the proposed Santa Rosa energy ordinance. The increased energy measures, their first cost and their resulting annual energy cost savings were then evaluated to determine a simple payback period.

950 SF 1-story home, without duct sealing **28.00% total fenestration** area:

- R-38 roof with radiant barrier
- R-13 exterior walls
- R-30 raised floor
- Vinyl Low-E windows, $U=0.35$, $SHGC=0.35$ w/ no overhangs
- Furnace: 80% AFUE / No Cooling
- R-6 ducts in the attic
- DHW: 40 gallon gas water heater, $EF=0.62$; no pipe insulation

1,418 SF (A/B) 2-story home, without duct sealing **26.83% total fenestration** area:

- R-38 roof with radiant barrier
- R-13 exterior walls
- R-30 raised floor
- Vinyl Low-E windows, $U=0.35$, $SHGC=0.35$ w/ a few small overhangs
- Furnace: 80% AFUE / No Cooling
- R-6 ducts in the attic
- DHW: 50 gallon gas water heater, $EF=0.62$; no pipe insulation

1,418 SF (C/D) 2-story home, with duct sealing **26.83% total fenestration** area:

- R-30 roof with no radiant barrier
- R-13 exterior walls
- R-19 raised floor
- Vinyl Low-E windows, $U=0.35$, $SHGC=0.35$ w/ a few small overhangs
- Furnace: 80% AFUE / No Cooling
- R-6 ducts in the attic
- DHW: 50 gallon gas water heater, $EF=0.58$; no pipe insulation

1,775 SF 2-story home as designed, **12.96% total fenestration** area:

- R-30 roof (attic and vaulted) with no radiant barrier
- R-13 and R-19 exterior walls (approx. 50% each type)
- 31% of house footprint R-19 raised floor
- 69% of house footprint covered slab floor
- Vinyl Low-E windows, $U=0.40$, $SHGC=0.38$ w/ one overhang
- Furnace: 90% AFUE
- Air conditioner: 13.0 SEER (minimum efficiency)
- R-6 ducts in the attic
- DHW: 50 gallon gas water heater, $EF=0.62$; no pipe insulation

2,682 SF 2-story home as designed, **22.26% total fenestration** area:

- R-38 roof with no radiant barrier
- R-13 exterior walls
- Covered slab-on-grade floor
- Vinyl Low-E windows: $U=0.35$, $SHGC=0.33$ w/ some overhangs and $U=0.40$, $SHGC=0.40$ with some overhangs
- Furnace: 80% AFUE
- Air conditioner: 13.0 SEER (minimum efficiency)
- R-6 ducts in the attic
- DHW: 50 gallon gas water heater, $EF=0.58$; no pipe insulation

3,024 SF 2-story home as designed, **22.91% total fenestration** area:

- R-38 roof with no radiant barrier
- R-13 exterior walls
- 78% of footprint is covered slab floor; 22% of footprint is R-19 raised floor
- Vinyl Low-E windows: $U=0.35$, $SHGC=0.33$ w/ some overhangs and $U=0.40$, $SHGC=0.40$ with some overhangs
- Furnace: 80% AFUE / No Cooling
- R-6 ducts in the attic
- DHW: 50 gallon gas water heater, $EF=0.58$; no pipe insulation

Low-rise Residential Energy Measures Needed to Meet the City's Ordinance.

Incremental energy measures to meet the Ordinance have been evaluated. The following energy features have been modified from the Title 24 measures so that these home designs use 15% less TDV energy than the Title 24 standard design.

950 SF, No Cooling and w/ Cooling (same energy measures)

- Reduced duct leakage [HERS]: incremental cost = \$ 500 (no sampling)
 - Super Low-E windows, SHGC=0.23: incremental cost = \$ 378
-
- | | |
|--------------------------|------------|
| Total incremental cost: | \$ 878 |
| Incremental cost, \$/SF: | \$ 0.92/sf |

With Sampling of HERS Measures (assumes an average of one in five homes verified):

- Reduced duct leakage [HERS]: incremental cost = \$ 300 (sampling)
 - Super Low-E windows, SHGC=0.23: incremental cost = \$ 378
-
- | | |
|--------------------------|------------|
| Total incremental cost: | \$ 678 |
| Incremental cost, \$/SF: | \$ 0.71/sf |

1418 SF (A), No Cooling

- Reduced duct leakage [HERS]: incremental cost = \$ 500 (no sampling)
 - Reduced building leakage, SLA=3.0: incremental cost = \$ 400 (no sampling)
 - Kitchen Pipe Insulation: incremental cost = \$ 100
-
- | | |
|--------------------------|------------|
| Total incremental cost: | \$1000 |
| Incremental cost, \$/SF: | \$ 0.71/sf |

With Sampling of HERS Measures (assumes an average of one in five homes verified):

- Reduced duct leakage [HERS]: incremental cost = \$ 300 (sampling)
 - Reduced building leakage, SLA=3.0: incremental cost = \$ 400 (sampling)
 - Kitchen Pipe Insulation: incremental cost = \$ 100
-
- | | |
|--------------------------|------------|
| Total incremental cost: | \$ 800 |
| Incremental cost, \$/SF: | \$ 0.56/sf |

1418 SF (B), No Cooling

- Reduced duct leakage [HERS]: incremental cost = \$ 500 (no sampling)
 - Super Low-E windows, SHGC=0.23: incremental cost = \$ 540
 - Kitchen Pipe Insulation: incremental cost = \$ 100
-
- | | |
|--------------------------|------------|
| Total incremental cost: | \$1140 |
| Incremental cost, \$/SF: | \$ 0.80/sf |

With Sampling of HERS Measures (assumes an average of one in five homes verified):

- Reduced duct leakage [HERS]: incremental cost = \$ 300 (sampling)
 - Super Low-E windows, SHGC=0.23: incremental cost = \$ 540
 - Kitchen Pipe Insulation: incremental cost = \$ 100
-
- | | |
|--------------------------|------------|
| Total incremental cost: | \$ 940 |
| Incremental cost, \$/SF: | \$ 0.66/sf |

1418 SF (C), No Cooling: Base Case includes duct sealing

• Reduced building leakage, SLA=3.0: incremental cost =	\$ 500 (no sampling)
• Super Low-E windows, SHGC=0.23: incremental cost =	\$ 540
• <u>0.62 EF water heater: incremental cost =</u>	<u>\$ 250</u>
Total incremental cost:	\$1290
Incremental cost, \$/SF:	\$ 0.91/sf

With Sampling of HERS Measures (assumes an average of one in five homes verified):

• Reduced building leakage, SLA=3.0: incremental cost =	\$ 300 (sampling)
• Super Low-E windows, SHGC=0.23: incremental cost =	\$ 540
• <u>0.62 EF water heater: incremental cost =</u>	<u>\$ 250</u>
Total incremental cost:	\$1090
Incremental cost, \$/SF:	\$ 0.77/sf

1418 SF (D), No Cooling: Base Case includes duct sealing

• R-38 attic insulation: incremental cost =	\$ 130
• Super Low-E windows, SHGC=0.23: incremental cost =	\$ 540
• <u>0.80 EF water heater: incremental cost =</u>	<u>\$1100</u>
Total incremental cost:	\$1770
Incremental cost, \$/SF:	\$ 1.25/sf

1775 SF, No Cooling

• Roof radiant barrier: incremental cost =	\$ 245
• Reduced duct leakage [HERS]: incremental cost =	\$ 550 (no sampling)
• Reduced building leakage, SLA=3.0: incremental cost =	\$ 400 (no sampling)
• Some R-21 wall and R-30 floor insulation: incremental cost =	\$ 70
• <u>All Pipe Insulation: incremental cost =</u>	<u>\$ 200</u>
Total incremental cost:	\$1465
Incremental cost, \$/SF:	\$ 0.83/sf

With Sampling of HERS Measures (assumes an average of one in five homes verified):

• Roof radiant barrier: incremental cost =	\$ 245
• Reduced duct leakage [HERS]: incremental cost =	\$ 325 (sampling)
• Reduced building leakage, SLA=3.0: incremental cost =	\$ 280 (sampling)
• Some R-21 wall and R-30 floor insulation: incremental cost =	\$ 70
• <u>All Pipe Insulation: incremental cost =</u>	<u>\$ 200</u>
Total incremental cost:	\$1120
Incremental cost, \$/SF:	\$ 0.63/sf

1775 SF, w/ Cooling

• Reduced duct leakage [HERS]: incremental cost =	\$ 550 (no sampling)
• Reduced building leakage, SLA=3.0: incremental cost =	\$ 400 (no sampling)
• TXV Verification: incremental cost =	\$ 50 (no sampling)
• <u>EER Verification: incremental cost =</u>	<u>\$ 50</u>
Total incremental cost:	\$1050
Incremental cost, \$/SF:	\$ 0.59/sf

With Sampling of HERS Measures (assumes an average of one in five homes verified):

• Reduced duct leakage [HERS]: incremental cost =	\$ 325 (sampling)
• Reduced building leakage, SLA=3.0: incremental cost =	\$ 280 (sampling)
• TXV Verification: incremental cost =	\$ 50 (sampling)
• <u>EER Verification: incremental cost =</u>	<u>\$ 50</u>
Total incremental cost:	\$ 705
Incremental cost, \$/SF:	\$ 0.40/sf

2682 SF, No Cooling

• Reduced duct leakage [HERS]: incremental cost =	\$ 650 (no sampling)
• Reduced building leakage, SLA=3.0: incremental cost =	\$ 400 (no sampling)
• <u>0.62 EF water heater: incremental cost =</u>	<u>\$ 250</u>
Total incremental cost:	\$1300
Incremental cost, \$/SF:	\$ 0.48/sf

With Sampling of HERS Measures (assumes an average of one in five homes verified):

• Reduced duct leakage [HERS]: incremental cost =	\$ 375 (sampling)
• Reduced building leakage, SLA=3.0: incremental cost =	\$ 300 (sampling)
• <u>0.62 EF water heater: incremental cost =</u>	<u>\$ 250</u>
Total incremental cost:	\$ 925
Incremental cost, \$/SF:	\$ 0.34/sf

2682 SF, w/ Cooling

• Reduced duct leakage [HERS]: incremental cost =	\$ 650 (no sampling)
• TXV Verification: incremental cost =	\$ 50 (no sampling)
• EER Verification: incremental cost =	\$ 50
• <u>0.62 EF water heater: incremental cost =</u>	<u>\$ 250</u>
Total incremental cost:	\$1000
Incremental cost, \$/SF:	\$ 0.37/sf

With Sampling of HERS Measures (assumes an average of one in five homes verified):

• Reduced duct leakage [HERS]: incremental cost =	\$ 375 (sampling)
• TXV Verification: incremental cost =	\$ 10 (sampling)
• EER Verification: incremental cost =	\$ 50
• <u>0.62 EF water heater: incremental cost =</u>	<u>\$ 250</u>
Total incremental cost:	\$ 685
Incremental cost, \$/SF:	\$ 0.26/sf

3024 SF, No Cooling

- Reduced duct leakage [HERS]: incremental cost = \$ 700 (no sampling)
 - Reduced building leakage, SLA=3.0: incremental cost = \$ 400 (no sampling)
 - 0.62 EF water heater: incremental cost = \$ 250
- | | |
|--------------------------|------------|
| Total incremental cost: | \$1350 |
| Incremental cost, \$/SF: | \$ 0.45/sf |

With Sampling of HERS Measures (assumes an average of one in five homes verified):

- Reduced duct leakage [HERS]: incremental cost = \$ 400 (sampling)
 - Reduced building leakage, SLA=3.0: incremental cost = \$ 300 (sampling)
 - 0.62 EF water heater: incremental cost = \$ 250
- | | |
|--------------------------|------------|
| Total incremental cost: | \$ 950 |
| Incremental cost, \$/SF: | \$ 0.31/sf |

3024 SF, w/ Cooling

- Reduced duct leakage [HERS]: incremental cost = \$ 700 (no sampling)
 - TXV Verification: incremental cost = \$ 50 (no sampling)
 - EER Verification: incremental cost = \$ 50
 - 0.62 EF water heater: incremental cost = \$ 250
- | | |
|--------------------------|------------|
| Total incremental cost: | \$1050 |
| Incremental cost, \$/SF: | \$ 0.35/sf |

With Sampling of HERS Measures (assumes an average of one in five homes verified):

- Reduced duct leakage [HERS]: incremental cost = \$ 400 (sampling)
 - TXV Verification: incremental cost = \$ 50 (sampling)
 - EER Verification: incremental cost = \$ 50
 - 0.62 EF water heater: incremental cost = \$ 250
- | | |
|--------------------------|------------|
| Total incremental cost: | \$ 750 |
| Incremental cost, \$/SF: | \$ 0.25/sf |

Note that the incremental energy design improvements specified above to meet the proposed Ordinance requirements do not include many building or system measures which also can effectively be used within the Title 24 performance method. Depending upon the specific opportunities available for a particular building design and orientation, a building can use additional measures in an enormous variety of combinations to meet the proposed Santa Rosa requirements including:

- Additional HERS measures such as insulation quality, duct design and proper cooling equipment sizing;
- Thermal mass credit when the sum of all interior masonry surfaces exceed 30% of the conditioned floor area of the house; and,
- Additional fixed overhangs and side-fins for glazing which are effective within the Santa Rosa climate zone; and,
- Credit for zonal controls for living and sleeping zones within a home.

2.2 Low-rise Multifamily Buildings

8,442 SF, 8-Unit, 2-story building, no cooling, 12.49% total fenestration area:

- R-38 roof with radiant barrier
- R-13 exterior walls
- Covered slab-on-grade floor
- Vinyl Low-E windows: $U=0.39$, $SHGC=0.33$, no overhangs
- Furnaces: 80% AFUE / No Cooling
- R-6 ducts in the attic
- DHW: 30 gallon gas water heaters, $EF=0.62$; full pipe insulation

8,442 SF, 8-Unit, 2-story building, w/ cooling, 12.49% total fenestration area:

- R-38 roof with radiant barrier
- R-13 exterior walls
- Covered slab-on-grade floor
- Vinyl Low-E windows: $U=0.39$, $SHGC=0.33$, no overhangs
- Split Heat Pumps: $HSPF=8.0$, $SEER=14.2$ / $EER=11.8$
- R-6 ducts in the attic
- DHW: 30 gallon gas water heaters, $EF=0.62$; kitchen pipe insulation

Low-rise Multifamily Energy Measures Needed to Meet the City's Ordinance.

Incremental energy measures to meet the Ordinance have been evaluated. The following energy features have been modified from the Title 24 measures so that these multifamily buildings use 15% less TDV energy than the Title 24 standard design.

8442 SF, 8-Units, No Cooling

- From 80% furnaces and ducts to 0.80 EF tankless water heaters for combined DHW & space heating w/ fan coils
incremental cost (includes savings for no furnaces, etc.) = \$5600
Total incremental cost: \$5600
Incremental cost, \$/SF: \$ 0.66/sf

8442 SF, 8-Units, w/ Cooling

- Reduced duct leakage [HERS]: incremental cost = \$2600 (sampling)
 - Reduced building leakage, $SLA=3.0$: incremental cost = \$2000 (sampling)
 - TXV Verification: incremental cost = \$ 100 (sampling)
 - EER Verification: incremental cost = \$ 100 (sampling)
 - All DHW pipes insulated: incremental cost = \$ 400
-
- Total incremental cost: \$5200
Incremental cost, \$/SF: \$ 0.62/sf

2.3 High-rise (Four-Story) Multi-Family Buildings

The following methodology and assumptions are used in evaluating the impact of the Ordinance on four-story multi-family buildings which are defined as “High-rise Residential” buildings under the Title 24 Building Energy Efficiency Standards.

30 Unit Apartment Building. A four-story building, with the top three floors containing 30 apartments with a total conditioned floor area of 27,600 square foot has been modeled in two ways to determine the cost-effectiveness of the proposed City of Santa Rosa Energy Ordinance. The total glazing area for this building is a Window Wall Ratio (WWR) of 35.2%, typical of this occupancy type.

The same set of Title 24 energy measures is used as the base case for comparison with two sets of energy measures developed to just meet the City’s proposed energy ordinance which requires that high-rise residential buildings exceed Title 24 by 15%. The added (i.e., incremental) energy measures were evaluated to determine a simple payback period including cumulative first cost and cumulative annual energy cost saving.

27,600 SF 4-story building w/ three stories of apartments which just meet Title 24:

- R-30 attic roof w/ cool roof
- R-19 in metal frame exterior walls
- Dual pane NFRC-rated Low-E windows: U-factor=0.39, SHGC=0.37; w/ exterior shading equivalent modeled (i.e. effective SHGC=0.30)
- Floor over conditioned Retail 1st floor (not modeled)
- Central domestic hot water boiler, 82.7% AFUE
- Room Heat Pumps: 7.2 HSPF, 10.2 SEER

High-rise Residential Energy Measures Needed to Meet the City’s Ordinance.

Incremental energy measures to meet the Ordinance have been evaluated for the above 4-story apartment building. The following energy features have been modified from the Title 24 measures so that these home designs use 15% less TDV energy than the Title 24 standard design.

27,600 SF, 30-Unit Apartment Building (A)

- | | |
|------------------------------------------------------------------------------|------------|
| • Super Low-E windows, SHGC=0.23: incremental cost = | \$ 6645 |
| • Room Heat Pumps: 11.2 SEER, 7.84 HSPF (2/Apartment):
incremental cost = | \$ 12000 |
| Total incremental cost: | \$ 18645 |
| Incremental cost, \$/SF: | \$ 0.68/sf |

27,600 SF, 30-Unit Apartment Building (B)

- | | |
|----------------------------------------------------------------|------------|
| • <u>60% Net Solar Fraction thermal solar hot water system</u> | \$ 54000 |
| Total incremental cost: | \$ 54000 |
| Incremental cost, \$/SF: | \$ 1.96/sf |

3.0 Cost Effectiveness

3.1 Single Family Houses

The cost effectiveness of meeting the requirements of the Ordinance is calculated for the home designed analyzed two different ways above. This reflects the different ways that architects, builders and home owners choose to meet the basic Title 24 requirements depending on preferences which often put window selection and constraints first. The total incremental first cost of the measures needed to meet the Santa Rosa Ordinance is divided by the incremental annual energy cost saving to establish the Simple Payback for the additional energy features. The study uses an average utility rate price of **\$0.163/kWh** for electricity and **\$1.30/therm** for natural gas.

Table 3-1a: Summary of Energy Savings from Santa Rosa Energy Measures

House Design	Electricity Saving (kWh/yr)	Gas Saving (therms/yr)	Electricity Cost Saving (\$)	Nat. Gas Cost Saving (\$)	Total Annual Cost Saving (\$)
950 sf, No Cooling	413	14	\$67	\$18	\$ 86
950 sf w/ Cooling	413	14	\$67	\$18	\$ 86
1418sf (A), No Cooling	114	96	\$19	\$125	\$ 143
1418sf (B), No Cooling	468	23	\$76	\$30	\$ 106
1418sf (C), No Cooling	410	31	\$67	\$40	\$ 107
1418sf (D), No Cooling	417	35	\$68	\$46	\$ 113
1775sf, No Cooling	197	83	\$32	\$108	\$ 140
1775sf, w/ Cooling	244	72	\$40	\$94	\$ 133
2682sf, No Cooling	158	166	\$26	\$216	\$ 242
2682sf, w/ Cooling	226	119	\$37	\$155	\$ 192
3024sf, No Cooling	81	172	\$13	\$224	\$ 237
3024sf, w/ Cooling	144	124	\$23	\$187	\$ 211

Table 3-1b: Summary of Simple Payback for Santa Rosa Energy Measures

House Design	Incremental First Cost Compared w/ Title 24 House (\$) ¹	Net Incremental Annual Energy Cost Saving (\$) ²	Simple Payback ^{1,3} (Years)
950 sf, w & wo/ Cooling	\$678 - \$878	\$62 - \$55	10.9 – 16.0
1418sf (A), No Cooling	\$800 - \$1000	\$115 - \$108	7.0 – 9.3
1418sf (B), No Cooling	\$940 - \$1140	\$73 - \$66	12.9 – 17.3
1418sf (C), No Cooling	\$1090 - \$1290	\$69 - \$62	15.8 – 20.8
1418sf (D), No Cooling	\$1770	\$51	34.7
1775sf, No Cooling	\$1120 - \$1465	\$101 - \$89	11.1 – 16.6
1775sf, w/ Cooling	\$705 - \$1050	\$108 - \$96	6.5 – 10.9
2682sf, No Cooling	\$925 - \$1300	\$210 - \$197	4.4 – 6.6
2682sf, w/ Cooling	\$685 - \$1000	\$168 - \$157	4.1 – 6.4
3024sf, No Cooling	\$950 - \$1350	\$204 - \$190	4.7 – 7.1
3024sf, w/ Cooling	\$750 - \$1050	\$185 - \$174	4.1 – 6.0
Simple Averages:	\$1078, \$0.55/SF	\$112	9.6

Note 1: The minimum value assumes a production home scenario in which no more one in five homes is used as a sample in verifying all HERS measures.

Note 2: This value is the Incremental Annual Energy Cost shown in Table 3-1a reduced by the average after-tax interest paid on a 6% APR mortgage loan covering the Incremental First Cost (30-year fixed loan, averaged over the first 20 years of the loan representing the average useful life of the energy measures).

Note 3: Simple Payback assumes that a homeowner pays to build their home, and that the added cost of energy measures will be paid back in utility bill savings. This assumption may not be applicable to builders who may not be able to recapture the extra cost of energy measures in the sale of a home.

Based on this data, the Ordinance increases the cost of construction by approximately \$0.35 to \$0.75 per square foot, for which the energy cost savings as a simple payback from first cost may be in the range of 5 to 15 years.

If the overall cost of new residential construction, including the cost of land and other related permit fees, is in the range of \$300 to \$400 per square foot, the Ordinance will increase that overall cost by approximately one-tenth to two-tenths of one percent.

3.2 Low-rise Multifamily Buildings

The cost effectiveness of meeting the requirements of the Ordinance is calculated for an actual 8-unit multifamily building submitted to the Santa Rosa building department in the past year. The building was analyzed two different ways. The total incremental first cost of the measures needed to meet the Santa Rosa Ordinance is divided by the incremental annual energy cost saving to establish the Simple Payback for the additional energy features. The study uses an average utility rate price of **\$0.163/kWh** for electricity and **\$1.30/therm** for natural gas.

Table 3-2a: Summary of Energy Savings from Santa Rosa Energy Measures

Multifamily Design	Electricity Saving (kWh/yr)	Gas Saving (therms/yr)	Electricity Cost Saving (\$)	Nat. Gas Cost Saving (\$)	Total Annual Cost Saving (\$)
8442sf, No Cooling	478	2008	\$78	\$2610	\$ 2688
8442sf, w/ Cooling	5327	13	\$868	\$17	\$ 885

Table 3-2b: Summary of Simple Payback for Santa Rosa Energy Measures

Multifamily Design	Incremental First Cost Compared w/ Title 24 House (\$)	Net Incremental Annual Energy Cost Saving (\$) ¹	Simple Payback (Years)
8442sf, No Cooling	\$9600	\$2493	3.9
8442sf, w/ Cooling	\$5200	\$704	7.4

Note 1: This value is the Incremental Annual Energy Cost shown in Table 3-1a reduced by the average after-tax interest paid on a 6% APR mortgage loan covering the Incremental First Cost (30-year fixed loan, averaged over the first 20 years of the loan representing the average useful life of the energy measures).

Based on this data, the Ordinance increases the cost of low-rise multifamily construction by approximately \$0.20 to \$0.40 per square foot, for which the energy cost savings as a simple payback from first cost may be in the range of 5 to 10 years.

If the overall cost of multifamily residential construction, including the cost of land and other related permit fees, is in the range of \$300 to \$400 per square foot, the Ordinance will increase that overall cost by approximately one-tenth of one percent.

3.3 High-rise (Four-Story) Multi-Family Buildings

The cost effectiveness of meeting the requirements of the Ordinance is calculated for a prototype 30-unit, four story building (residential units on the top three floors). The building was analyzed two different ways. The total incremental first cost of the measures needed to meet the Santa Rosa Ordinance is divided by the incremental annual energy cost saving to establish the Simple Payback for the additional energy features. The study uses an average utility rate price of **\$0.163/kWh** for electricity and **\$1.30/therm** for natural gas.

Table 3-3a: Summary of Energy Savings from Santa Rosa Energy Measures

Building Design	Electricity Saving (kWh/yr)	Gas Saving (therms/yr)	Electricity Cost Saving (\$)	Nat. Gas Cost Saving (\$)	Total Annual Cost Saving (\$)
27600sf (A) w/ Cooling	8315	0	\$1355	\$0	\$ 1355
27600sf (B) w/ Cooling	0	2180	\$0	\$2847	\$ 2834

Table 3-3b: Summary of Simple Payback for Santa Rosa Energy Measures

Building Design	Incremental First Cost Compared w/ Title 24 House (\$)	Net Incremental Annual Energy Cost Saving (\$)	Simple Payback (Years)
27600sf (A) w/ Cooling	\$18645	\$1355	13.8
27600sf (B) w/ Cooling	\$54000	\$2834	19.1

Based on this data, the Ordinance increases the cost of construction by approximately \$0.65 to \$2.00 per square foot, for which the energy cost savings as a simple payback from first cost may be in the range of 15 to 20 years.

If the overall cost of new construction, including the cost of land and other related permit fees, is in the range of \$300 to \$400 per square foot, the Ordinance will increase that overall cost by approximately two-tenths to six-tenths of one percent.

Conclusions

Regardless of the design and occupancy profile of a building, the improvement in overall annual energy performance as a result of the City's Ordinance is relatively reliable with respect to the building's Title 24 TDV energy. However, a building's specific design, occupancy, and the particular design choices used to meet the state's energy code and then go beyond that level of energy performance to meet the City's Ordinance allow for a large range of first cost and payback period. As is the case in meeting the requirements of the Title 24 standards, a permit applicant seeking to meet the requirements of the City's Ordinance should analyze building energy performance to reduce the incremental installed cost and reduce the cost payback period for additional energy measures.

4.0 Implementation Plan

The implementation of the City of Santa Rosa energy ordinance for low-rise residential buildings involves a simple verification that the performance CF-1R form shows that the proposed building TDV energy use is at least 15% less than the Title 24 standard design.

For high-rise residential and nonresidential buildings, there will be either one or two pages of additional forms which can be printed out from an Excel spreadsheet available from the City of Santa Rosa, or be filled in on a pre-printed form with calculations provided by the City.

The City of Santa Rosa plan review will involve:

- (a) Verifying the occupancy type(s) and scope of work to determine whether and how the Ordinance applies;
- (b) Checking the drawings, specifications and regular Title 24 documentation under the 2005 Building Energy Efficiency Standards; and,
- (c) Checking any additional forms needed to demonstrate compliance with the Ordinance for high-rise residential buildings.

Field inspection will be essentially identical to working with the current standards. Gabel Associates will work in conjunction with the City of Santa Rosa to plan all aspects of the implementation, including training for the building department, local energy consultants and other interested parties (e.g., designers and builders) who would like to learn more about how to meet the Ordinance's energy requirements.

Additional Training for Building Department Staff

As part of the implementation of the proposed Ordinance, the City will make an extra effort to provide appropriate training and review of both the current energy standards and the new local energy requirements for building department staff.

5.0 Text of the Santa Rosa Ordinance

ORDINANCE OF THE CITY COUNCIL OF THE CITY OF SANTA ROSA, CALIFORNIA, ADDING CHAPTER 18-34, LOCAL ENERGY EFFICIENCY STANDARDS TO THE SANTA ROSA CITY CODE FOR THE PURPOSE OF ADOPTING LOCAL ENERGY EFFICIENCY STANDARDS FOR BUILDINGS COVERED BY THE 2005 CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS

WHEREAS, California Health and Safety Code Sections 18938 and 17958 provide that the California Building Standards Code establishes building standards for all occupancies throughout the State; and

WHEREAS, Health and Safety Code Section 17958.5 provides that a city may establish more restrictive building standards if they are reasonably necessary due to local climatic, geological or topographical conditions; and

WHEREAS, the City Council has found that certain modifications and additions to the California Building Standards Code are reasonably necessary based upon local climatic, topographical and geological conditions; and

WHEREAS, on September 25, 2007, the City Council directed city staff to prepare an ordinance for the City of Santa Rosa that would increase local energy efficiency standards for certain buildings currently covered by the 2005 California Building Energy Efficiency Standards; and

WHEREAS, on October 16, 2007, the City Council created a local advisory committee including certain members of the community having diverse areas of expertise and thereby appointed members to serve on the Green Building Policy – Council Advisory Committee for to consider the cost of implementing stricter local energy efficiency standards and to recommendations to Council; and

WHEREAS, Public Resource Code Section 25402.1(h)(2) states that a local enforcement agency may adopt more restrictive energy standards when they are cost-effective and approved by the Energy Commission; and

WHEREAS, Gabel Associates, LLC, with input from the Santa Rosa Green Building Policy – Council Advisory Committee, has conducted a study to show that the energy conservation measures contained in this ordinance are cost-effective; and

WHEREAS, the City included the Gabel Associates study in an application for consideration by the California Energy Commission in compliance with Public Resources Code 25402.1(h)(2); and

WHEREAS, energy efficiency is a key component to sustainability; and

WHEREAS, California has been known to experience rolling blackouts during periods of peak energy use due to energy demands greater than what the state's electrical energy system can provide; and

WHEREAS, the burning of fossil fuels used in the generation of electric power and heating of buildings contributes to global warming; and

WHEREAS, increased global warming could have a significant adverse impact on the local climate and economy; and

WHEREAS, the governor of California signed Assembly Bill 32 into law on September 27, 2006, which directs the California EPA to put a cap on the generation of greenhouse gas emissions; and

WHEREAS, in accordance with the 2005 California Building Energy Efficiency Standards, including California Code of Regulations, Title 24, Parts 1 and 6 (Standards) all residential development must meet or exceed the energy requirements contained therein; and

WHEREAS, it is the purpose and intent of this ordinance to amend the abovementioned standards as described herein; and

WHEREAS, City staff has prepared a new chapter to Title 18 of the Santa Rosa City Code, which is Chapter 18-34 – Local Energy Efficiency Standards, as directed by the City Council.

NOW THEREFORE, THE PEOPLE OF THE CITY OF SANTA ROSA DO ENACT AS FOLLOWS:

Section 1. Chapter 18-34, “Local Energy Efficiency Standards,” is hereby added to Title 18, “Buildings and Construction,” of the SANTA ROSA CITY CODE to read and provide as follows:

“Chapter 18-34 Local Energy Efficiency Standards

18-34.010 Findings.

The modifications to the 2005 California Building Energy Efficiency Standards are reasonably necessary due to local climatic conditions. As a result of summer ambient temperatures, average load demand and peak load demand of energy used in Santa Rosa are important factors concerning public safety and adverse economic impacts of power outages or power reductions (i.e., “brown-outs”). Reduction of total and peak energy use as a result of incremental energy conservation measures required by this ordinance will have local and regional benefits in the cost-effective reduction of energy costs for the building owner, additional available system energy capacity, and a reduction in greenhouse gas emissions.

18-34.020 Purpose.

This ordinance sets forth minimum energy efficiency standards within the City of Santa Rosa for all new residential construction. This Chapter is intended to supplement the 2005 California Building Energy Efficiency Standards, as specified in the California Code of Regulations, Title 24, Parts 1 and 6 (Standards), adopted by the City at Title 18, Chapter 18-33 of the City Code. Compliance with the 2005 California Building Energy Efficiency Standards is required even if the increased minimum efficiency standards in this Chapter do not apply.

18-34.030 Definitions.

For purposes of this Chapter 18-34, words or phrases used in this Chapter that are specifically defined in Parts 1, 2 or 6 of Title 24 of the California Code of Regulations shall have the same meaning as given in the Code of Regulations. In addition, the following words and phrases shall have the meaning indicated herein:

(A) “2005 Building Energy Efficiency Standards” shall mean the Standards and regulations adopted by the California Energy Commission contained in Parts 1 and 6 of Title 24 of the California Code of Regulations as such standards and regulations may be amended from time to time.

(B) “Nonresidential Compliance Manual” shall mean the manual developed by the California Energy Commission, under Section 25402.1(e) of the Public Resources Code, to aid designers, builders, and contractors in meeting the requirements of the state’s 2005 Building Energy Efficiency Standards for nonresidential, high-rise residential, and hotel/motel buildings.

(C) “Residential Compliance Manual” shall mean the manual developed by the California Energy Commission, under Section 25402.1(e) of the Public Resources Code, to aid designers, builders, and contractors in meeting the requirements of the state’s 2005 Building Energy Efficiency Standards for low-rise residential buildings.

(D) “Time Dependent Valuation of Energy or (“TDV Energy”))” shall mean the time varying energy caused to be used by the building to provide space conditioning and water heating and, for specified buildings, lighting. TDV Energy accounts for the energy used at the building site and consumed in producing and in delivering energy to a site, including but not limited to, power generation, transmission and distribution losses. TDV Energy is expressed in terms of thousands of British thermal units per square foot per year (kBtu/sq.ft.- yr.).

18-34.040 Buildings Covered.

The provisions of this ordinance shall apply to all new residential construction of any size for which a building permit has been applied and accepted as complete by the Building Division on or after the effective date of this ordinance. Subject to the foregoing limitation, the coverage of this Chapter shall be determined in accordance with the scope and application of either the Residential Compliance Manual or the Nonresidential Compliance Manual, as appropriate for the proposed occupancy.

18-34.050 Compliance.

The building official for the City of Santa Rosa shall be charged with enforcing the provisions of this ordinance. A building permit subject to the provisions of this chapter shall not be issued by the City’s building division unless the energy compliance documentation submitted with the permit application meets the requirements of this chapter. A final inspection for a building permit subject to the requirements of this chapter will not be approved unless the work authorized under a permit has been constructed in accordance with the approved plans and requirements of this chapter.

18-34.060 General Compliance Requirements.

In addition to the requirements of the 2005 Building Energy Efficiency Standards, the following general compliance requirements shall apply to all permit applications subject to this chapter:

(A) **Low-Rise Residential Buildings.** When an application for a building permit involves a new low-rise residential building, the performance approach specified in Section 151 of the 2005 Building Energy Efficiency Standards must be used to demonstrate that the TDV Energy of the proposed building is at least 15.0% less than the TDV Energy of the standard building.

(B) **High-Rise Residential Buildings.** Applications for building permits that involves a new high-rise residential building shall demonstrate compliance with the requirements of this chapter using either the Prescriptive Approach or the Performance Approach, as follows:

(1) **Prescriptive Approach.** If the building permit applicant chooses the prescriptive approach, the applicant shall use the Overall Envelope Approach as specified in Section 143(b) of the 2005 Building Energy Efficiency Standards to demonstrate that the Overall Heat Gain of the proposed building is at least 10.0% less than the Overall Heat Gain of the standard building; and the Overall Heat Loss of the proposed building is at least 10.0% less than the Overall Heat Loss of the of the standard building; or

(2) **Performance Approach.** If the applicant chooses the performance approach, the applicant shall select one of the following energy budget calculation methodologies to demonstrate the compliance with the requirements of this chapter:

(a) **Building Envelope Only.** Model the building envelope only using a stat-approved energy compliance software program and demonstrate that the TDV Energy of the sum of the Space Heating, Space Cooling and Indoor Fans energy components of the proposed building is at least 15.0% less than the TDV Energy of the sum of the Space Heating, Space Cooling and Indoor Fans energy components of the standard building; or

(b) **Building Envelope and Mechanical System.** Model the building envelope and mechanical system using a state-approved energy compliance software program and demonstrate that the TDV Energy of the sum of the Space Heating, Space Cooling, Indoor Fans, Pump and Heat Rejection energy components of the proposed building is at least 15.0% less than the TDV Energy of the sum of the Space Heating, Space Cooling, Indoor Fans, Pump and Heat Rejection energy components of the standard building.

(C) **Documentation.** In order to demonstrate compliance with the requirements of this Section, a permit applicant may be required to submit supplementary forms and documentation in addition to the building drawings, specifications, and standard Title 24 report forms, as deemed appropriate by the City's building official.

18-34.070 Enforcement.

(A) Civil Penalties. Any person who violates any provision of this chapter is liable to the City for a civil penalty of one thousand dollars.

(B) Cumulative Remedies. The foregoing remedy shall be deemed nonexclusive, cumulative and in addition to any other remedy the City may have at law or in equity, including but not limited to injunctive relief to prevent violations of this chapter.

18-34.080 Expiration.

This chapter 18-34 shall expire upon the date that the state's 2008 Building Energy Efficiency Standards take effect."

Section 2. Severability. Should any section, subsection, paragraph, sentence, clause, or phrase of this ordinance be declared unconstitutional or invalid for any reason, such declaration shall not affect the validity of the remaining portions of this ordinance.

Section 3. Efforts to Enhance Local Compliance. Given that the purpose of this ordinance is to adopt stricter local energy efficiency standards for the construction of new residences within the City, the Council further recognizes that the adoption of new standards without additional education and training for City staff responsible for enforcement of the standards, could diminish compliance and potentially undermine the efficacy of the ordinance. Therefore, in order to ensure greater compliance and enforcement of the applicable energy efficiency standards, better equip building department staff and provide a greater resource to the City's building community, the City will seek out additional education and training opportunities for building department staff in the areas of energy standards, technology and implementation.

Section 4. Environmental Compliance. The proposed ordinance preserves and enhances the environment, in that it would set forth minimum energy efficiency standards within the City of Santa Rosa for all new residential construction. In accordance with CEQA Section 15061(b)(3), "[C]EQA applies only to projects, which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA." Staff has determined that the proposed ordinance is exempt from CEQA review.

Section 5. Effective Date. This ordinance shall be in full force and effective 30 days after its adoption, and shall be published or posted as required by law.

This ordinance was introduced on the ____ day of _____, _____ and

AYES:

NOES:

ABSENT:

ABSTAIN:

CITY OF SANTA ROSA

Mayor

ATTEST:

City Clerk

APPROVED AS TO FORM:

City Attorney